DISCUSSION AND CORRESPONDENCE

ISOLATION OF B. RADICICOLA FROM SOIL

TO THE EDITOR OF SCIENCE: I am indebted to Dr. F. Löhnis, of the United States Department of Agriculture, for two corrections which I deem it important to make with reference to the paper by Mr. Fowler and myself in SCIENCE of February 12, 1915, on "The Isolation of *Bacillus radicicola* from the Soil."

The first error is one merely of oversight, and concerns the date in which Beijerinck gave the name *Bacillus radicicola* to the legume-root nodule organism. That date should of course be 1888 and was put down as 1901 merely through carelessness on my part, and I gladly plead guilty to that.

The second error is that which is partially due to our tentative claim to priority in the direct isolation of *Bacillus radicicola* from the soil. Dr. Löhnis informs me that claims were made to the isolation directly from the soil of the organism in question by both Beijerinck and by Nobbe, et al. I do not regard the evidence put forward by Beijerinck as conclusive on that point, but there is no question at all that the second investigator named, with his coworkers, has conclusively demonstrated the presence of *Bacillus radicicola* in the soil and has also, by its isolation in pure culture, been able further to reinoculate plants grown under otherwise sterile conditions. Our neglect to take note of this last-named investigation was due to the manner of indexing pursued in the important abstract journals as well as other scientific journals which gave no useful reference to the work just referred to.

CHAS. B. LIPMAN

A RESEARCH LABORATORY FOR THE PHYSICAL SCIENCES

CONVERSATION with a number of men interested in the biological sciences and who have availed themselves of the opportunity for research work at Woods Hole, Mass., brings out the idea that one great benefit to be derived from the work there is the association with men from all parts of the country. I think all men of science will agree that the great stimulus which comes from the various meetings of scientific bodies is in the private discussion, which the men have, one with the other, on subjects in which they are particularly interested. Think what it would mean to men in the physical sciences if they could have a laboratory where for two or three months each year, at least, they could meet and carry on some research work and at the same time enjoy the fellowship of men who come from widely separated points but who are interested in their particular field.

I realize that the equipment of a laboratory for physics involves a large outlay of money and transportation of apparatus is not easy, but would the first be impossible? In other words, the object of this note is to raise the question as to whether a laboratory for the physical sciences, similar to that for the biological sciences at Woods Hole, would be a feasible and a desirable project. I believe that many chemists and physicists would be very glad to spend their summer vacation at such a laboratory if it were located, as the one at Woods Hole, where there would be a chance for an outing as well. As at Woods Hole, there would be a resident director and the laboratory would be kept open throughout the year for those who might have a year's leave of absence from their work in teaching.

That men of wealth, who would be interested in building and equipping such a laboratory, might be found does not seem such a vagary in view of what has been accomplished for special laboratories.

S. R. WILLIAMS

PHYSICAL LABORATORY,
OBERLIN COLLEGE

SCIENTIFIC BOOKS

The Salton Sea. A study of the geography, the geology, the floristics and the ecology of a desert basin. By D. T. MACDOUGAL and Collaborators. Carnegie Institution of Washington, Publication 193, 1914. 4to. Pp. 182, with plates, maps and figures in the text.

The making of a lake in a desert basin, whose floor lies below the level of the sea-sur-

face is a circumstance which when within the frontiers of civilization is too rare not to attract wide attention, much intensified by a consequent deflection of a trunk line of railway, the loss of an industry of corporation magnitude and the threatening of areas of cultivation. But in spite of vast antagonism, as measured by money and effort, this is what happened when the waters of the Colorado, first as a tiny stream, but at last as a torrent, entered the Salton Sink through the New River during the few years following 1904. If the lack of foresight which led to this is to be deprecated, it is of no meager congratulation that, precisely as the opportunity was afforded, the Desert Laboratory of the Carnegie Institution of Washington was organized and disposed toward the study of the progress of events by scientific methods. This progress is not completed, nor will be for many years, but the careful planning and continuity of study till the present moment, as witnessed by the volume before us, furnish a sure foundation, under the permanency of a stable organization such as the Carnegie Institution, for a future following of events, so that we may confidently hope at the end to have a more complete and accurate account of the complex interplay of events projected over larger places and times than has yet been produced by science. The case illustrates the necessity of the times. Mutual cooperation of students in diverse fields is becoming more and more imperative, if a satisfying solution of any problem is to be had. For a skilful observation of the Salton Sink a geographer, two geologists, several chemists and various kinds of botanists, probably a working minimum, have been needed.

The work under review may be said to have been begun by the late Professor William Phipps Blake, who, as geologist to the official U. S. Railway Survey which in 1853 had the task of exploring the southern portion of the Sierra Nevada, first comprehended the nature of the Salton basin. An account of the region written by Professor Blake only two years before his death, fittingly introduces the reader to the volume. A strong note of human interest is found in a photograph of Professor Blake standing on the travertine formation 53 years after the date of his original discovery of it. There is a historic justice in the fact that Professor Blake was permitted to see serious work begun in this desert, for his vast and intimate experience in the southwestern deserts had been but for his death of great value to it.

The dynamic geography of the region is presented by Mr. Godfrey Sykes, who bases his conclusions on the records of the early explorers, tradition and evidence observed ad hoc. The Salton Sink represents the northern extremity of the Gulf of California which has been cut off by the formation of a huge natural dam, the ridge of which extends from the Algodones Sandhills to Cerro Prieto. If this is true the major beach line identical with that of the present gulf should be, in view of tidal action, 20 to 30 feet higher than sea-level, and in view of prevailing winds, higher on the northeastern shore than on the opposite, and this Mr. Sykes finds to obtain. Rocque's map (1762) indicates that previous to 1762 or thereabout, the Colorado and Gila jointly flowed into an extensive lake, and Indian tradition comports with this. Since 1890 water from the Colorado has at various times found its way into the sink, so that the flooding of recent years was an event following the reopening of a nearly healed wound. When the flood was dammed, the waters found their way chiefly into Hardy's Colorado, and incidentally the Pattie Basin is receiving a part of the surcharge.

A different view is taken by Mr. E. E. Free, who, in a sketch of the geology and soils, regards the evidence that the basin was never occupied by the sea, any further north at any rate than Carrizo Creek. The absence of marine shells, and presence of millions of fresh-water shells, the occurrence of travertine, the amount of salt deposited and the condition at the present time of the major beach all speak for a genetic precursor of the present waters in a fresh water lake, happily called Blake Sea, which has disappeared in comparatively modern times by evaporation. The formation of the dam which excludes the

waters of the gulf has been built up *pari passu* with a subsidence of the region, bringing the lake floor below sea-level. This view, though championed with moderation, is pretty strongly buttressed by evidence. It is, however, evident that more work may profitably be directed to the problem.

It may be noted in passing that the recent flooding of a portion of the alkaline playa soil has not materially altered its salt content. If leaching out has occurred, the evaporation from the newly exposed lake floor has restored the salts to the soil.

The general position based upon geologic evidence taken by Mr. Free receives additional support from the study of the nature and amount of salinity by Dr. W. H. Ross, who finds that the concentrations and solid components of the Salton Sea to be such as to indicate an originally fresh-water body.

The increasing concentration of these various solutes is found by Dr. A. E. Vinson not to have proceeded at equal rates for all. The potassium-sodium ratio has changed, the former element having remained relatively constant while the concentrations of calcium and magnesium have increased at slower rates. The latter fact is explained by the formation of travertine, the composition of which is largely of the salts (carbonate and sulfate) of those elements.

The following paper on the behavior of organisms in brine, by Professor G. J. Peirce is introduced, aside from its intrinsic merit, evidently by reason of its future relevancy to expected conditions in the Salton Sea, as evaporation proceeds to the production of a maximum concentration of solutes.

For a single instance, it will be important to follow the racial history of the bacteria which are the agents of cellulose hydrolyses in submersed plant tissues, as shown in another paper by Dr. M. A. Brannon to occur as agents of disintegration in the Salton waters. The increasing salinity of these waters offers a succession of barriers beyond which only those forms which possess suitable capabilities of physiological adjustment may pass. It is obviously important to determine these capabilities.

The subjects for Dr. Peirce's study were found in the salt ponds on San Francisco Bay. A lively impression of the wide adaptability of the living organism is had from the persistence of numerous minute green algæ and bacteria which inhabit their waters at whatever concentrations. Of these a chromogenic bacterium responsible for the red coloration of salted codfish, has been isolated and shown to be the cause of the color of the brine and salt. It will come as a shock to those who have supposed a complete preservation to be effected by salting to know that decay may still proceed in fish saturated with salt if exposed to humid air and a moderate temperature. The fluctuations in concentration and composition of the waters of "pickle ponds" and salterns strongly umbrate the theory of balance in solutions, since it is difficult to believe that such relations can here obtain. It was also found that cell division in the protophytes varies inversely to the concentration, being halted by the higher, and stimulated by a lowering.

The deposits of tufa which characterize most markedly a vertical zone 200 feet deep, limited above by the major beach line of Blake Sea, were studied by Dr. J. Claude T. Jones, who shows conclusively its origin to be in the activity of minute algæ vegetation (*Calothrix* sp.). By a method not yet understood, certain organisms, *e. g., Chara,* caused the calcium salts to be thrown out of solution in their immediate neighborhood. When the organisms are minute and very numerous a *quasi* continuous material (sinter) is formed, found however to possess a structure which may be regarded, in a rough sense, as coralline. Imbedded in the tufa of the Salton are found snail shells. Here therefore is further evidence of the fresh-water character of the Blake Sea. The study of tufas on the slopes of ancient lakes must reveal much sure information of their previous history.

Mr. S. B. Parish contributes a paper on the "Plant Ecology and Floristics of the Salton Sink." His long previous acquaintance with the flora of the southwestern deserts places him in a position to offer a particularly complete statistical study of that portion of it included in the region in question. Of 202 species listed, 48 are introduced, and of these it is

important to note that not one has been able to establish itself under constant natural conditions. Of the remaining 131, all but six or seven are more or less widely distributed, chiefly in the surrounding country. But these few appear to be endemic, as they have not been found elsewhere. The suggestion is obvious that these have originated in the sink during comparatively recent times, while it is further pointed out by Dr. MacDougal that other species may have similarly arisen, but have succeeded in passing outwardly beyond the limits of their original home. There is an approach here to something like quantitative relations between geological age and the possible number of new specific origins.

It seems equally probable that other plants, such as the desert palm *Washingtonia filifera* and *Populus Macdougalii,* are to be referred, as to their origin, to comparatively recent dates, and this locality.

The absence of succulent xerophytes, including under this term those with water-storage roots, from this very pronounced desert region is worthy of remark, since, in the minds of many, succulence is regarded as the final expression of desert adaptation. Here the xerophytic shrub with spinose parts and other appropriate characters are the chief perennial inhabitants of the slopes and older strands, while the salt-laden alluvium of the sink-floor bears a zone of the salt-bushes, *Atriplex* spp.

The final paper of the series concerns the movements of the vegetation due to submersion and desiccation and is by Dr. D. T. MacDougal, under whose leadership the whole work has been carried forward. Recognizing the importance of the opportunity to observe the advance of plants upon an immense sterilized area especially in view of the inadequate study or total neglect of analogous earlier opportunities (one thinks of the lost one of Mont Pelée), the lavas of Hawaii, studied by C. N. Forbes excepted, the task was laid out on a comprehensive but workable scale. Sample areas or "belt transects," a mile in width, normal to the beach lines, were chosen, and these, together with sterilized islands, afforded the basis for exhaustive study. This, as the reader will have understood from what has already been said, embraced not only the vegetation, but the salt content of soil and water and other relations. Usually semi-annual visits were made for the collection of data.

The first half of the paper presents the facts concerning the reoccupation of the strands of six successive years, and a partial study of another, namely, 1913. The earlier strands of Blake Sea, untouched by the recent invasion of waters, afforded a standard for comparison, so that it was possible to measure the rate at which the facies of the new strands took on the same composition as obtains now in the old, relatively static strands. It was observed that the recession of the water was so soon followed by desiccation of the soil that wholly desert conditions were established in the course of a couple of years, and that, in consequence, the introduction of xerophytes identical with those characteristic of the ancient Blake Sea strands had been accomplished in the course of three or four years. The change from close to open formation was similarly rapid.

The transition from one environment to another as the established desert gives way to strand, and the gradual alteration of successive zones correlated with the recession of the water, together with the separation of shore and sterilized islands by extensive water ways, sets up conditions for the study of methods of dissemination and of natural selection as well as reoccupation. It is of more than incidental importance that the reoccupation of islands, and of one shore from another, was among other methods possible chiefly by the flotation of seeds and fruits as proved by many experimental tests. It is clear that in this can be seen no causal relation between the conditions and the "adaptations to flotation." Nature had otherwise been peculiarly far-sighted in furnishing to desert plants not only adaptations in harmony with their immediate surroundings, but with a possibility so remote as the occurrence of a lake! Causal relations are, however, to be seen probably in such characters as reduced superficies, thickened outer tissues, and the like, as a direct result of evaporation, and a number of such correlations have been

or can be made the subject of experimental investigation. To what extent the colloidal substances of cells, such as the mucilage dissolved in the sap, can be made use of, and how this use may be modified by the acid or alkaline content of the disperse medium is at present almost or quite unknown. The great size of tannin idioplasts and the imbibitional avidity of their colloidal content may, it is quite possible, be related, and it is similarly possible that the growth and therefore the size of other cells may depend not only on the "turgor" relations, but even more upon the imbibition pressure exerted upon their walls. The mucilage and other colloidal content of desert succulents *par excellence* may in this light take on greater significance in view of Borowikow's work, cited by MacDougal.

Much more of detail from this collection of papers could be given with more ease than to indicate, without giving an impression of meagerness in the source, the most salient points. Many people untaught in the thought of the scientist have expected vast changes in the surrounding country to follow the flooding of a large desert-inclosed area. The emersed bed of Blake Sea is, however, still a desert, and as measurement and even more superficial observation shows, the evaporation from the many square miles of water surface has had no smallest effect upon any vegetation but that immediately following recedence of the water itself. A very short span of time and the desert is restored to its own. But the opportunity of seeing what does happen has fortunately been seized, and we have in this review seen, it is hoped, that a result of signal value has rewarded.

FRANCIS E. LLOYD

MCGILL UNIVERSITY

SCIENTIFIC RESEARCH AND SIGMA XI[1]

BEFORE the chapter reports are presented, it is my business for twenty minutes to address you, yours to listen; for Sigma Xi too expects every man to do his duty. We have eaten; water has been served; it is a pity that we can not now be merry. For whatever may happen to us, Sigma Xi will not die to-morrow. We have long since passed through the dangerous period of infancy; at the age of twenty-seven the death-rate is but five per thousand. And we surely are a chosen people; like the patriarchs of old, the years of our life are measured not by decenniums but by centuries.

Our first quarter century has indeed been a period of marvelous growth and fruition. As exhibited in the record and history admirably compiled by our secretary, it is one of the fairy tales of science, incredible if it were not true. The beginnings at Cornell University were small, but, like the zygote, they contained the elements which in interaction with a fit environment grew into the great organism, of which each of us is one seven-thousandth. Unlike the individuals of the species to which we belong, our corporate growth does not stop at the age of twenty-five, nor will senility follow fifty years of activity.

In a recent article an eminent American statistician states that 30.7 per cent. of Rhode Island native-born married Protestant mothers are childless. The distinguished dean of a great woman's college within a thousand miles of Philadelphia in a chapel address to the students said that it is not just to charge the decreasing birth rate to the higher education of women; although the college had been established only a few years, forty per cent. of its alumnæ were married and sixty per cent. of them had children. When birth-rate statistics are so complicated, it may not be safe to state that we are all the children of Henry Shaler Williams. But this is true, though polyandry appears on the records and we have certainly had polygamous nursing. We may indeed regard our leaders and each of us as somas of the immortal germ plasm, which seeks the light of truth:

> That light whose smile kindles the universe,
> That beauty in which all things work and move.

As a hand apart from the body is not a hand, as a man apart from other men is not a man, so a scientific man is not conceivable

[1] Remarks by the president of the Society of the Sigma Xi at the annual dinner given at the University of Pennsylvania on January 4, 1915.